Installation of Digital Data Receivers

The invention which is the subject of this application is to provide apparatus and a method of installation of digital data receivers which are used to receive data which is broadcast from a remote location and process the data to generate video, audio and/or auxiliary data, and for the implementation and installation of the receivers at the premises where the invention is to be used.

Conventionally, digital data is broadcast from one or a number of remote locations and is transmitted either via a satellite system, cable network system or terrestrial systems and can be received at a number of premises which are provided with the appropriate data receiving equipment. When the data is received, it is passed to a receiver apparatus which is typically provided with processing means which allow the decoding of the data, processing of the data and the generation of video, audio and/or auxiliary data therefrom.

At the present time, when a customer orders a receiver, and/or wishes to subscribe to service providers, the receiver and data receiving apparatus is required to be installed at the premises of the customer by an installation operator.

As part of the installation procedure, the operator is required to measure the power levels of the incoming signals on which the data is carried to ensure that the levels are within designated parameters and that the installation is correct for the customer before leaving. In order to be able to do this, relatively expensive and complex equipment is required to be used. If the measurements received are not within certain parameters, then the operator may be required to fit attenuators and/or other components to bring the operation of the receiver within the required parameters and this can be time

consuming for the operator as it requires the operator to perform a hardware fitting operation at the location of the receiver.

The aim of the present invention is to provide apparatus and a method for installing a receiver which allows for the reduction in time required for the installation and, furthermore, allows for the installation to be accurate and relatively easily performed by the operator.

In a first aspect of the invention there is provided a method of installation of a receiver to receive broadcast data (BDR) which is broadcast to the location of the receiver, said method comprising, measuring the power level of incoming frequency signals at two predetermined spaced points on the signal band by measuring the content of the AGC (automatic Gain Control) converters within the receiver, providing an amplitude correction filter which can be selectively operated at the RF input to allow the correction of amplitude variations with frequency, the selective operation of the filter dependent upon the power level measurements.

Thus the invention allows the control system to address the way in which the problems of Intermodulation distortion in a cable network are reduced. In accordance with the invention and without the knowledge of the network cable slope, the Broadcast data receiver can adjust its internal gain structure so as to allow relatively weak received signals to be correctly processed.

Typically, the method will allow for the receiver, during the installation procedure, to take into account the power level measurements automatically and make the required corrections as part of the automatic installation procedure. This overcomes the need for the installation operator to use expensive equipment and take time to measure the signals manually.

Typically, in the method, if the high end signal level is greater than the low end signal level, then no linearization is required. However, if the relative power difference is greater than a predetermined level, such as, for example, 10dB then the linearization circuit can be utilised to adjust the power level so that the incoming signal is within a known power range. In this manner, the method utilises the ability to use the relative signal strength rather than absolute signal strength to install the receiver and therefore avoids the need for the operator to undertake the initial measurements during the installation procedure.

In a further aspect of the invention there is provided a broadcast data receiver apparatus for receiving broadcast digital data which is transmitted and received by the apparatus and passed to the receiver via an RF input from the data carrying network, said receiver including a linearization circuit which can be selectively activated to operate with the receiver control system upon comparison of measurements of the power levels at two predetermined points on the incoming frequency signal and, if the comparison reveals a difference which is greater than a predetermined level, the linearization circuit is activated to adjust the receiver settings during the installation procedure for the BDR at a location at which the same is to be subsequently used.

In one embodiment the linearization circuit is selectively activated automatically by the receiver control system upon specified criteria for activation being met.

In an alternative embodiment the linearization circuit is selectively activated by the receiver installer, upon the installer receiving an indication by visual and/or audible indication means, that the

specified criteria for operation of the linearization circuit have been met.

The linearization circuit typically performs cable slope correction internally in the BDR and this can be applied to improve the performance of the BDR at the location of installation. The internal changes performed can include changing the values of the inductors, capacitors and/or resistors to obtain one of a number of equalisation slopes to bring the difference between the high end signal and low end signal within a specific margin. In one use the specific criteria for operation of the linearization cicrcuit is for a difference between the high end and low end signal values greater than 10 dB.

In a yet further aspect of the invention there is provided a method of installation of a receiver to receive digital data which is broadcast to the location of the receiver, said method comprising, measuring the power level of incoming frequency signals at two predetermined spaced points on the signal band, providing means for the comparison of the measurements and if the comparison shows a value within a predetermined parameter an indication is provided to the installer and if the comparison shows a value outwith the predetermined parameter a control system in the receiver adjusts the operation of one or a combination of components within the receiver until the value is within the predetermined parameter.

Typically the extent and level of adjustment is made with reference to at least one algorithm in the control system.

In one embodiment the components which are adjusted are any, or any combination of capacitors, inductors, resistors.

Thus, the present invention provides at the installation of the receiver, for measurements to be taken to indicate whether the receiver is working correctly, but rather that the conventional approach in which the installer is required to perform hardware adjustments to bring the measured values within the acceptable operating parameters, the receiver in accordance with the invention is provided with the processing and control capacity to undertake the comparison of the measured values and compare with predetermined parameters. If the values are acceptable, an indication is provided to the installer but if not the control system for the receiver undertakes adjustments of the operation of one or a plurality of components in the receiver until the values are acceptable. This means that the installer does not have to perform the hardware adjustments and does not have to carry relative complex equipment to perform the installation. The indication of when the receiver is within the predetermined parameters and/or when adjustments are being made can be displayed as on screen messages. Although receivers which are provided to receive data via cable broadcast systems are particularly susceptible, it should be appreciated that the invention can be utilised in any system where it may of potential benefit to the installation procedure.

Specific embodiments of the invention will now be described with reference to the accompanying diagrams, wherein:-

Figure 1 illustrates a linearization circuit in accordance with one embodiment of the invention; and

Figure 2 illustrates the manner in which adjustments can be made if required.

The apparatus and method as herein described is of particular relevance to receivers which are provided to receive digital data via

a cable network where the digital data is transmitted by a broadcaster and to the customer via a cable network system. When a customer subscribes to the service they need to have a receiver and this is typically installed by an operator acting on behalf of the cable network provider. As part of the installation procedure, and as part of the current invention, the installation apparatus and circuitry within the receiver is set to measure the power level of the incoming signal at two predetermined positions, typically at the bottom and top of the band. This measurement is undertaken by measuring the content of the AGC converters. Typically, most receivers require two tuners and at present each has an AGC circuit and for large dynamic range inputs, a switch filter is required. However, by implementing the invention as herein described, only one AGC switch filter is required and, furthermore, the AGC circuit can be simplified. At present most single conversion tuners use switched in filters to overcome problems such as intermodulation problems however these filters are reflective in that they attenuate a signal by reflecting the signal back but this provides a problem in that it degrades the return loss.

As part of the invention a switched equaliser is provided which attenuates the unwanted signals and this has the advantage that the return loss is never degraded.

When the measurements are taken it is found that most cable receivers have problems when changing to high frequencies because of these losses. Figure 1 shows a simple circuit which is suitable for most cable receivers in that if the measurements taken at the bottom and top of the band indicate that the high end signal level is greater than the low end signal level, then no linearization, 2 is required. If however a relative power difference is greater than a predetermined level such as 10dB then a switch in linearization circuit 4 is used to equalise either the XdB or YdB as required so

that the incoming signal is then within predetermined parameters. Thus, a relative signal strength is used rather than the absolute signal strength to set up the receiver and this displays to the installer if there is a network problem. Furthermore, the receiver can, if there is a problem, utilise circuitry provided in the receiver to take into account the problem.

Figure 2 illustrates how by changing the values of the inductors 6, capacitors 8 and/or resistors 10, varying equalisation slopes can be obtained and the difference between the high end signal and low end signal brought to within the required parameter which therefore means that the receiver is installed to operate within the required parameters.

Thus at least two cost savings can be achieved using this invention, the material cost of tuners in the Broadcast data receiver (BDR) Materials used and reduction in the time and cost in the installation and/or field service support of the receivers in situ.The material cost saving centres on the performance requirements of thetuner(s) used in the BDR. Here cost is directly related to theperformance required and the invention, by adding a circuit to the BDR which, when combined with the ability to then use lower cost tuners, effectively transform the low cost tuners to operate in a manner similar to high performance tuners yet still be significantly cheaper than the cost of high performance tuners.

For example, for a BDR for the USA market a cost difference of$3.00 per tuner could be achieved. This is based on the following current pricing:-

Cost of high performance tuner $11.00
Cost of low cost tuner $6.00
Cost of circuit in accordance with the invention $2.00

Turning now to the savings related to the time and cost for installation and field service support. The saving in installation relates tolocations in which BDR's are used and where the data is provided via a cable distribution network and where there is a large slope on the cable feed. This large slope is typically due to thelength of the cable run. At the present time the installation engineer has to either addslope compensation amplifiers or put in more signal attenuation in order tooptimise the cable feed. This process takes time and requires cable feedmeasuring equipment to be carried by the engineer. This process is also prone to field service problems asperformance even after installation may be marginal. In accordance with the present invention the circuit which is introduced performs cable slope correction internally in the BDR and soat installation, the BDR, by using it's own software, can apply the cable slope correction in order to optimise performance without the intervention of the installation engineer. In service, the STB can then monitor performance and change the level of slope correction as the feedslope changes.

Thus it will be clear that the provision of the invention minimises installation time, does not require the installer to measure cable feed slope and, external to the BDR correct that slope, and reduces field service calls relating to changes in the cable feed slope.

It should also be appreciated that as these data carrying network customer loading increases as more customers installed adverse changes in cable feed slope and power levels are expected so that the problem addressed by this invention is likely to increase so that he benefits to be obtained by the invention increase as the same is used with increased frequencies.

It should also be appreciated that although this invention is primarily described with reference to data carried along cable

networks the invention can be equally applicable to other data carrying systems such as satellite systems and/or terrestrial network systems.